CANADA'S URANIUM INDUSTRY - PROSPECTS FOR THE FUTURE

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INTRODUCTION

Canada is the world's leading producer and exporter of uranium. In 1990, total output of some 8 730 tonnes of uranium (tU)* was equivalent to about 30 per cent of the Western world's total. The past year has seen a number of very significant developments, in Canada and elsewhere, which may have important implications for the future of Canada's uranium industry, indeed for the uranium industry as a whole.

In Canada, after several years of speculation, the future of Ontario's Elliot Lake uranium producing area is now clear. In all likelihood, operations there will cease in 1996, bringing to an end an important chapter in the history of Canadian uranium production dating back to the mid-1950s. On the other hand, the future for Saskatchewan's uranium industry appears much brighter. A major new discovery was announced in May 1990 and several potential production projects are at various stages of development, in anticipation of improvements in the uranium market in the mid-1990s.

In Saskatchewan, a new process for environmental assessment and review of proposed new uranium mining facilities has been launched, in response to increased public awareness of the potential impact of such developments on the environment. While the process has a number of very positive features, it is viewed with apprehension by some, and may be considered as a model for other jurisdictions in Canada and elsewhere.

There have been several other developments on the world scene that will affect the future uranium supply situation, including decisions to close uranium production facilities in other producing countries, notably in France, South Africa and the United States, a decision to continue the "three-mine" policy in Australia, changes in ownership of production facilities that have contributed to a concentration of companies involved in the international marketing of uranium, and the availability of new sources of uranium from non-traditional suppliers in the wake of the emancipation of Eastern Europe.

Uranium prices remained soft in 1990 and early 1991, with little prospect for immediate recovery, notwithstanding the projected need for new production facilities sometime in the mid-1990s. Not surprisingly, worldwide uranium exploration activity remains low and, except for the McArthur River discovery in northern Saskatchewan, there have been no significant discoveries announced in the world in the past two years.

This paper will review some of these developments in the context of the current market outlook in an attempt to examine their potential impact on the future of the uranium industry in general and of Canada's uranium industry in particular.

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* One metric ton (tonne) of elemental uranium (U), written as tU, is equivalent in terms of uranium content to 1.2999 short tons of uranium oxide (U_3O_8).

PRODUCTION DEVELOPMENTS

Canada has long been the world's principal exporter of uranium and in 1984 it replaced the United States as the Western world's leading producer (**Figure 1**). Canada's annual production accounts for almost a third of the Western world total. While primary output exceeded 11 320 tU in 1989, it declined in 1990 due to mine closures and cut-backs in production. In 1990, producers reported production of concentrates containing 8 730 tU, and shipped some 9 460 tU valued at $Cdn 870 million.

As of January 1991, only four uranium production centres were operating in Canada (**Figure 2**). At Elliot Lake, Ontario, both Rio Algom Limited and Denison Mines Limited had one operation in production; both operate conventional underground mines and also recover uranium using in-place leaching techniques. In Saskatchewan, Cluff Mining and Cameco Corporation* each had one conventional operation in production; a second Cameco operation was on standby. Cameco produces from open pit mines whereas Cluff Mining produces from both open-pit and underground mines. Saskatchewan producers account for some two-thirds of Canada's production, with the remaining third coming from producers in the Elliot Lake area.

Elliot Lake Situation

During 1990 the uranium market deteriorated to the point that Rio Algom was forced to make plans to close two of its three Elliot Lake operating facilities (**Figure 3**). The Quirke and Panel operations ceased production in August 1990 and, at the same time, Denison reduced its workforce by about 450 in line with expected cuts in uranium production.

In April 1991, Denison announced that Ontario Hydro had given Notice of Termination of its uranium supply contract, effective January 1, 1993, and that Denison would permanently close its operation upon completion of contract deliveries, affecting some 1 000 workers. Subsequently, Denison reached an agreement with Ontario Hydro, whereby 1991 and 1992 deliveries will be accelerated, permitting current production and workforce levels to be maintained until closure in the second quarter of 1992.

In June 1991, Ontario Hydro announced that it had agreed to continue Rio Algom's current (Stanleigh mine) contract beyond the end of 1993, but only until mid-1996 as opposed to the original 2020 date; deliveries will be increased between 1992 and 1995, but at a lower average price, requiring the addition of up to 75 employees by early 1992. Stanleigh employed almost 500 at year-end 1990, some of whom were involved in asset disposal and environmental decommissioning activities related to the closure of the Quirke and Panel mines.

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* On November 1, 1990, the official name of *Cameco - A Canadian Mining & Energy Corporation* was shortened to *Cameco Corporation.*

The 1991 closure announcements did not come as a complete surprise in view of the 1990 shutdowns by Rio Algom. By mid-1991, over 2 000 jobs, representing more than 50 per cent of Elliot Lake's uranium-producing workforce, had been affected by closures and cutbacks. The population of Elliot Lake has declined from over 16 000 two years ago to around 12 500 today. The closures are bringing to an end a very important role for Elliot Lake as one of the principal suppliers of uranium to the world's nuclear power programs.

With the closure of the Elliot Lake operations, it appears unlikely that the remaining uranium resources will be economically recoverable by conventional methods in the near future, if ever.

Since 1956, a total of 12 underground mines and 10 ore processing plants have operated in the Elliot Lake area. To date more than 150 million tonnes of mill tailings have been accumulated, covering an estimated 11 km^2, at an average depth of 8 m. These tailings, which are acid generating due to their pyrite content and also contain uranium, radium and thorium, present a significant decommissioning challenge. Plans for decommissioning these operations have been prepared by the producers, and discussions with regulatory authorities are currently underway.*

Saskatchewan Operations

In Saskatchewan, Cameco did not operate its Rabbit Lake mill from July 1989 to August 1991, due to poor market conditions (**Figure 4**). During this period the mill capacity was expanded to a licensed maximum of 5 400 tU a year, and the Collins Bay "B" orebody was mined out and the ore stockpiled at the mill site for future processing. In addition, development work proceeded at Cameco's Eagle Point deposit, in preparation for a planned underground test mining program commencing in 1991.

At Cameco's Key Lake operation, production has now shifted from the Gaertner to the larger Deilmann pit, the former having been depleted. In mid-1990, the operation closed for six weeks due to continued market weakness. However, Key Lake's nominal mill capacity for the year was exceeded to compensate for its summer closure, as well as for the inactive Rabbit Lake operation. Mining at Key Lake is being accelerated so that the Deilmann pit can be depleted by 1995 for use as a tailings impoundment facility.

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* Radioactive Waste Management In Canada, Morrison, R.W., and Brown, P.A., a paper presented to the Uranium Institute's Sixteenth Annual Symposium, London, September 4-6, 1991.

After a four-month shutdown in late 1989 due to the depressed market, Cluff Mining resumed milling in January 1990 but on an alternate-week basis. Production came from the Dominique-Peter underground mine and the new Dominique-Janine North open pit. The latter is expected to be mined out in 1991 and plans have been made to extend the pit southward. At the end of 1990, Cluff Mining submitted an Environmental Impact Statement (EIS) for the extension to the Atomic Energy Control Board (AECB) for approval.

Ownership of Uranium Industry

There have been two recent ownership changes affecting Canada's uranium producing industry (**Table 1**). First, in July 1990, Cameco sold Uranerz Exploration and Mining Limited (UEM) a one-third interest in its Rabbit Lake operation and associated properties. Cameco and UEM now have identical equity splits (2/3 and 1/3, respectively) in both the Key Lake and Rabbit Lake operations, although Cameco operates both. UEM had acquired a one-third interest in the north part of the Eagle Point deposit in 1988 from Noranda Exploration Company, Limited.

Secondly, in May 1991, Cameco filed a preliminary prospectus for its initial share offering, as part of a plan to fully privatize the company on a phased basis by 1995. In July, more than 10 million shares were offered at a price of $12.50 each and within days the offering was fully subscribed, the gross proceeds reaching $130 million. Cameco is now held 20 per cent by the public, 49.2 per cent by the Government of Saskatchewan, and 30.8 per cent by the Government of Canada.

Additional Production Possibilities

In addition to the existing operations described above, several other producing projects could be developed before the end of the 1990s, should market conditions warrant (**Table 2**). The start-up date of any of these projects is contingent on the receipt of the necessary regulatory and environmental approvals and on developments in the international uranium market.

At Saskatchewan's Cigar Lake project, a 500m deep shaft was completed in May 1990, and lateral development proceeded in preparation for a planned test mining program in 1991. Test mining and bulk sampling could be completed by the end of 1991, permitting the preparation of an EIS and a mining feasibility report during 1992. Owners of Cigar Lake Mining Corporation, the project operator, include Cameco (48.75%), Cogema Canada Limited (36.375%), Idemitsu Uranium Exploration Canada Ltd (12.875%) and Korea Electric Power Corporation (2.0%).

At the Midwest project near South McMahon Lake, west of Rabbit Lake, the results of a year-long test mining program, have been completed and an EIS was submitted to the AECB in early 1991. Denison (45%) operates the joint venture; the other partners include UEM (20%), Bow Valley Industries Ltd (20%), and Overseas Uranium Resources Development Corporation (OURD) of Japan (15%).

In May 1990, Cameco announced the McArthur River discovery, 70 km northeast of Key Lake. The high-grade P2 North deposit, located at a depth of 500 to 550 m, has been reported to contain resources exceeding 77 000 tU grading more than 3 per cent U on average. Follow-up evaluations are continuing, with development timing scheduled to coincide with the depletion of stockpiled ore at Key Lake. The major joint venture partners are Cameco (44%), UEM (29%), AGIP Resources Ltd (10%), Interuranium Canada Limited (9%) and Cogema (6.5%).

Minatco Limited's Wolly project, located adjacent to the Rabbit Lake property, hosts significant uranium mineralization, including the McClean, Jeb, and Sue deposits. Minatco is continuing exploration and development work at Wolly, and has completed an EIS in preparation for a production decision by the mid-1990s. In late 1990, Minatco acquired 100 per cent of Wolly from joint venture partners Canadian Occidental Petroleum Ltd. and Canadian Nickel Company Limited.

Environmental Assessment and Review

Under the federal government's Environmental Assessment and Review Process (EARP), all projects for which the federal government holds decision-making authority - as a proponent, land manager, provider of funding or a regulatory authority - may be referred to the Minister of the Environment for public review by an independent Panel. Projects must be referred *"if the potentially adverse environmental effects of the proposal are significant"*, or *"if public concern about the proposal is such that a public review is desirable"*.

Pursuant to the EARP Guidelines Order of 1984, the AECB, as the federal nuclear regulator, has established an automatic referral list that includes proposals for new uranium mining facilities. Proposals for the expansion or extension of existing facilities may also be referred for review, following an AECB screening process.

Importantly, a decision of the Trial Division of the Federal Court of Canada in late 1989 in Saskatchewan's Rafferty-Alemeda Dam case dramatically changed the accepted understanding of the status of the EARP Guidelines Order. The Court was of the view that the EARP Guidelines Order was "binding, authoritative legislation". Subsequently, all federal government departments and agencies have been following the EARP Guidelines Order to the letter.

In April 1991, the Minister of Energy, Mines and Resources referred six proposals for new uranium mining facilities in Saskatchewan for public review by an independent Panel, pursuant to the EARP Guidelines Order. Since the Saskatchewan government has similar legal requirements for a public input process, there has been close co-operation between federal and provincial officials in developing a joint federal-provincial process to review the proposals.

Five of the proposals will be reviewed by a joint federal-provincial Panel, namely: the expansion of the Cluff Mining operation by developing the *South and West Dominique-Janine* deposits, the Denison Midwest Joint Venture *South McMahon Lake* project, the Minatco *McClean Lake* project, the Cigar Lake Mining project at *Cigar Lake*, and the Cameco *McArthur River* project. The sixth proposal, an expansion of Cameco's Rabbit Lake operation by development of the *Eagle Point/Collins Bay A & D* deposits, will be reviewed by a federal-only Panel, because conditional approval has already been granted by Saskatchewan authorities.

A five-member Panel to conduct the joint review of the five proposals was announced on August 22, 1991. The Panel,to be chaired by Dr. Donald Lee, Head of the University of Regina's Department of Chemistry, will endeavour to report its findings within 18 months. The announcement of Panel members and the terms of reference for a federal-only Panel to review the proposed extension of the Rabbit Lake operation had not been announced at the time of writing this paper.

It is important to emphasise that the six new uranium mining proposals are at quite different stages of planning, in anticipation of market opportunities later in the 1990s. EIS's have been submitted for four of the proposals, two of which are associated with existing producing operations (Eagle Point/Collins Bay and Cluff Mining), and two of which are for new operations (Midwest Lake and McClean Lake projects). EIS documents have not yet been prepared for the remaining two projects (Cigar Lake and McArthur River projects). The two Panels will take these differing stages of development into account in its review process.

Northwest Territories Developments

Urangesellschaft Canada Limited's (UCL) Kiggavik project, near Baker Lake, Northwest Territories was referred for review by an EARP Panel in late 1988. Public scoping workshops were held, guidelines for the preparation of an EIS were issued to UCL by June 1989, and UCL submitted its EIS in January 1990. However, in July 1990, UCL requested that the Panel delay indefinitely its planned public hearings. The company indicated that more time was needed "to respond thoroughly to the request for considerable additional information" resulting from the Panel's review of its Environmental Assessment Report. The project is held by UCL (79%), CEGB Exploration (Canada) Ltd (20%), and Daewoo Corporation (1%) of Korea.

Also of importance to proposed new uranium developments in the Keewatin district of the Northwest Territories (NWT) has been the recent work of the Nunavut Planning Commission, an independent body established jointly in 1989 by the federal Minister of Indian Affairs and Northern Development, and the Minister of Renewable Resources for the NWT, to develop a Land Use Plan for the Inuit land claims settlement area. The recommended Plan, which has been developed with public input, is scheduled to be tabled with Ministers this fall. In view of the very good potential for discovery of uranium deposits in the land claims settlement area, the work of the Planning Commission has been followed with interest by the industry.

The Plan is expected to recommend that the EARP Panel review of the Kiggavik proposal be completed, but that no uranium development take place until the Nunavut resource management bodies have been established, following implementation of the land claims settlement in 1992. The new resource management bodies would then have an opportunity to review all of the issues relevant to uranium mining and exploration that have not been addressed by the EARP Panel.

EXPLORATION AND RESOURCES

Total Canadian uranium exploration expenditures declined in 1990 by about 25 per cent to some $Cdn 45 million, reflecting a continued decline in grass-roots exploration efforts. Again, a significant portion of this total was attributable to underground geotechnical testing at Saskatchewan's Cigar Lake project. Foreign-based companies continued to account for about two-thirds of the total expenditures, a proportion that is significantly higher than in the early 1980s (**Figure 5**). While foreign involvement in uranium exploration in Canada is high, participation by U.S. firms has steadily decreased over the period to less than 1 per cent of total annual expenditures.

The number of active exploration projects fell to 33 in 1990, a drop of 40 per cent. Ten operators accounted for virtually the total $Cdn 45 million expenditure, and seven of these are companies whose majority interests are held outside of Canada. Several of those are supported, directly or indirectly, by their national governments in their uranium exploration efforts.

Recent exploration efforts have been highlighted by significant increments in higher-grade uranium resources, most notably in Saskatchewan at the McArthur River and Wolly projects, and in the Northwest Territories along the Kiggavik structural trend. Also of interest has been grass-roots exploration activity near Great Bear Lake, Northwest Territories, in search of deposits comparable to Australia's Olympic Dam copper, gold, uranium orebody.

The results of Energy, Mines and Resources' annual uranium resource assessment, released by the department this week, indicate that estimates of Canada's "known" uranium resources have increased by 11 000 tU to 594 000 tU (**Table 3**). The net overall increase in resources reflects the new discoveries referred to above, and more than offsets the drawdown from production, and the loss of resources as a result of developments at Elliot Lake, including consideration for mine closures in the area.

As noted in **Table 3**, Canada's estimates of known resources are sub-divided into categories according to differing degrees of geological assurance of existence. The estimates are also sub-divided into three different price categories to indicate their economic attractiveness. **Figure 6** illustrates that only some 43 per cent of Canada's known uranium resources is associated with EXISTING production centres. The bulk of the remainder is associated with PROSPECTIVE new production centres, primarily in northern Saskatchewan.

Only a small portion of Canada's production is required for domestic needs. **Figure 7** compares projections of Canada's domestic requirements and uranium production capability, based on EXISTING production centres only. The projected decline in production capability reflects the planned mine closures at Elliot Lake and the depletion of resources at other EXISTING production centres. As described above, there are several PROSPECTIVE new production centres that are undergoing environmental review, which could maintain Canada's production capability at least at current levels, given appropriate market incentives.

MARKETS AND TRADE

Canadian Uranium Markets

Canadian producers shipped some 9 460 tU in 1990 valued at $Cdn 870 million. About 80 per cent of this total was destined for the export market. Actual exports in 1990 were 8 648 tU, down slightly from 9 398 tU in 1989 and 10 434 tU in 1988. The average price of export deliveries in 1990 was $Cdn 71/kgU or $US 24/lb U_3O_8. Less than 1 per cent of all export deliveries in 1989 and 1990 were under spot sales, compared with 13 per cent in 1988, 35 per cent in 1987, and 21 per cent in 1986. Indeed, Cameco has reported that it purchased almost 1 000 tU on the spot market in 1990, rather than make deliveries from its own production.

Canada's domestic needs are primarily those required for Ontario Hydro's nuclear power program. As noted earlier, the utility will terminate its contracts with Denison and Rio Algom in 1992 and 1996, respectively, and will need to secure new sources of supply to cover its requirements beyond the mid-1990s. As of early 1991, following Ontario Hydro's decision to terminate its two principal contracts, total outstanding domestic commitments were in the order of 7 000 tU, reduced from some 70 000 tU a year earlier. At the end of 1990, total forward export commitments exceeded 60 000 tU, to be delivered over the period 1991 to 2003. This level of forward export commitments has remained fairly stable in recent years.

On a cumulative basis, Japan has been Canada's most important single customer since the beginning of the commercial contract era in the mid-1960s (**Figure 8**). Other important markets have been the European Economic Community, other Western European countries and, more recently, the United States. Indeed, over the past five years, the United States has received some 45 per cent of Canada's uranium exports (**Figure 9**). In 1990, the bulk of the some 8 000 tU in new Canadian export sales was negotiated with U.S. utilities, almost exclusively under long-term contracts. This illustrates the importance to Canada of the U.S. uranium market and the significance of the Free Trade Agreement (FTA) that was implemented between Canada and the United States in 1989.

Current Market Status

The uranium market has suffered from oversupply since the late 1970s, when surplus inventories began to accumulate due to delays and cutbacks in reactor construction, and declines in new reactor orders. Although reactor-related requirements have exceeded production since 1985, the drawdown of excess utility inventories has been slower than expected and a significant surplus still overhangs the market.

The oversupply situation has been exacerbated more recently by the availability of new sources of uranium from non-traditional suppliers, particularly the Soviet Union, certain Eastern European countries and China. Indeed, within the past year, the realization that the Soviet Union has a surplus uranium stockpile reported to be in excess of 200 000 tU has had both a real and psychological impact on the market.

The continuing oversupply situation has had a depressing effect on uranium prices, particularly in the spot market. In addition, intermediaries have become increasingly active, moving excess supplies into the market and thus contributing to increased spot-market price volatility (**Figure 10**). In 1990, for example, the NUEXCO Exchange Value ranged from a high of $US 11.70/lb U_3O_8 to a record low of $US 8.35/lb U_3O_8, ending the year at $US 9.70/lb U_3O_8. It has since fallen again below the $US 9.00/lb level.

It is important to emphasise that the spot market represents a relatively small proportion of the total market, and that spot prices are significantly lower than those being received under term-contracts, as illustrated in the comparison with average Australian and Canadian export prices in **Figure 10**. However, since prices under many term contracts are tied to spot price indices, the trend in average delivery prices is also down.

Unfortunately, there is little prospect for an early recovery in price levels. The gap between actual production and reactor requirements in the Western world has continued to widen and, at the end of 1990, was in excess of 16 000 tU. The difference between production and requirements has been drawn from surplus inventories and imports from non-traditional suppliers. The timing and magnitude of a recovery in prices will depend very much on how quickly surplus inventories can be absorbed. Perhaps more important, will be the extent to which non-traditional supplies are able to penetrate the market.

PROSPECTS FOR THE FUTURE

Supply-Side Considerations

In the context of the current weak uranium market, recent supply developments on the international scene may have some implications that should be of concern to consumers. Without some positive signs of price recovery, worldwide exploration levels are likely to remain low, or even decline further. Without additional discoveries, and with the permanent closure of existing production centres, the uranium industry's short-term supply capability, particularly that based on low-cost resources, will continue to erode. Clearly, the longer prices remain at their current low level, the higher the recovery in price will be when it occurs.

Although Canada has a number of possible new production operations in various stages of development, the potential environmental implications of their development will be the subject of intensive review before they receive regulatory approval. This Canadian experience is likely to be felt in other jurisdictions, and will inevitably lead to longer lead times and higher costs of development for new uranium production projects. Given these new realities, it would be imprudent to be complacent about the timing, availability and cost of uranium from potential new production projects.

In this new era of environmental consciousness, uranium producing operations may also be expected to comply with more stringent regulations with respect to radiation protection and safety. Recent recommendations of the International Commission on Radiological Protection (ICRP) that would lower the radiation dose limits for atomic radiation workers*, if adopted, could pose difficulties for some uranium producers. Preliminary studies indicate the lower limits may have a significant impact in terms of higher costs and possible mine closures, particularly with respect to high-grade underground mines. National regulators are currently studying the new recommendations to determine how best to implement them, and uranium producers are assessing the potential impact of the lower limits on their operations.

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* The ICRP has recommended that the effective dose limit for atomic radiation workers be lowered from the current 50 millisievert per year (mSv/a), to 20 mSv/a averaged over five years. Current representative radiation exposures of uranium miners in the major uranium producing countries are well below the existing regulatory limits (e.g., from 5-30 mSv/a in Canada), but may exceed the proposed new ICRP limits in some instances.

All such developments suggest a need for prices that are higher than those prevailing in the current marketplace. A recent Canadian study*, which examined the impact of taxation on uranium mining projects in Australia and Canada, supports this view with respect to the development of new uranium production projects. The study carried out for Energy, Mines and Resources Canada (EMR) by the Centre for Resource Studies (CRS) at Queen's University, concluded that *"only the very best uranium mining projects have a chance of being developed under current market conditions, and that even these can be rendered uneconomic by excessive taxation regimes. It follows that exceptionally good-quality targets will have to be identified to provide the economic justification for uranium exploration."*

Demand-Side Considerations

Although the current situation appears somewhat bleak on the demand side, there are some bright spots that indicate a better future. Nuclear power has become an integral part of the electricity supply mix in a large number of countries. Indeed, it is the major electricity supply source in many (**Figure 11**). As of the end of 1990, the International Atomic Energy Agency (IAEA) reported that 423 nuclear power units with a capacity of 326 gigawatts electric net (GWe) were installed in the world, and 83 more reactors having a total capacity of 66 GWe were under construction. Annual uranium requirements are expected to increase from a current level of some 55 000 tU per year to some 70 000 tU or more by 2005. Significantly, since 1986, the year of the Chernobyl accident, more than 80 new nuclear power units have been brought on line worldwide.

Clearly, nuclear power is a reality, and the existing and committed level of nuclear power plant capacity represents a solid basis for the uranium industry to continue to grow and prosper. Although there has been a dearth of nuclear plant orders around the world in the past few years, recent orders in Korea and Japan may be a promising sign. If the successful implementation of the nuclear component of the U.S. National Energy Strategy should precipitate a resurgence of orders in the United States, this may prove to be a catalyst for other countries. Unfortunately, such a resurgence in orders will not have a significant impact on the uranium industry until after the turn in the century.

Over the longer term, the IAEA has projected that global consumption of electricity will grow at an annual rate in excess of 3 per cent, with nuclear-electric generation increasing at just less than 3 per cent per year. Rates of growth in electricity demand and nuclear-electric generating capacity in parts of the developing world may well be higher. Beyond 2000, the future of nuclear power could also be affected by decisions taken in the next few years with regard to the environment. The growing awareness that nuclear power plants contribute little to global warming, and rising concern about the emission of CO_2 and other "greenhouse" gases may also contribute to a resurgence in nuclear power plant orders.

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* Mackenzie, Brian W. et al, "Uranium Mining in Canada and Australia: The Impact of Taxation", Centre for Resource Studies, Queen's University, Kingston, Ontario, 1991 (in press).

CONCLUSIONS

It is clear that nuclear power will continue to play an important role in the electricity supply mix in many countries. Despite the large number of uncertainties in the uranium supply-demand equation, most analysts continue to project a need for new production centres in the mid-1990s. This conclusion assumes that there will be some penetration of the Western market by non-traditional suppliers, but that their market share will not be overly significant. It is inevitable that uranium prices must rise, and the longer the current depressed market persists, the more abrupt and extreme the price rise is likely to be. An orderly development in the market would undoubtedly be preferable for all concerned.

Canada's uranium industry is well placed to maintain its role as the world's principal uranium supplier. Saskatchewan's existing producers are amongst the most modern and competitive in the world, and several possible new production projects are currently under environmental review in anticipation of market opportunities later in the decade. However, these new facilities will not be committed without adequate assurances from the market.

Canada's potential for additional uranium discoveries is excellent and policies have been put in place designed to encourage investment in the industry, and to maintain Canada's role as a reliable and competitive supplier for its trading partners. Given its many strengths, the prospects for the future of Canada's uranium industry must be viewed with cautious optimism.

TABLE 1

OWNERSHIP IN CANADA'S URANIUM PRODUCING INDUSTRY, 1991		
PRODUCING OPERATION	OPERATING ENTITY	OWNERSHIP (%)
Denison	Denison Mines Limited	Denison (100)
Stanleigh	Rio Algom Limited	Rio Algom (100)
Key Lake	Cameco Corporation	Cameco ($66^2/_3$) UEM* ($33^1/_3$)
Rabbit Lake	Cameco Corporation	Cameco ($66^2/_3$) UEM* ($33^1/_3$)
Cluff Lake	Amok Ltd for Cluff Mining	Amok (80) Cameco (20)

* UEM = Uranerz Exploration and Mining Limited

TABLE 2

OWNERSHIP IN CANADA'S PROPOSED NEW URANIUM PROJECTS, 1991		
PROJECT	OPERATOR	OWNERSHIP (%)
SASKATCHEWAN		
South McMahon Lake (Midwest Project)	Denison Mines Limited	Denison (45), UEM (20), Bow Valley Industries Limited (20), & OURD of Japan (15)
McClean Lake (Wolly Project)	Minatco Limited	Minatco (100)
Cigar Lake	Cigar Lake Mining Corporation	Cameco (48.75), Cogema Canada Limited (36.375), Idemitsu Uranium Exploration Canada Ltd (12.875) & Korea Electric Power Corporation (2)
McArthur River	Cameco Corporation	Cameco (44), UEM (29), AGIP Resources Ltd (10), Interuranium Canada Limited (9), & Cogema (6.5)
NORTHWEST TERRITORIES		
Kiggavik	Urangesellschaft Canada Limited	Urangesellschaft (79), CEGB Exploration Canada Ltd (20), & Daewoo Corporation of Korea (1)

TABLE 3

ESTIMATES OF CANADA'S KNOWN URANIUM RESOURCES RECOVERABLE FROM MINEABLE ORE AS OF 1/1/91			
PRICE RANGES WITHIN WHICH MINEABLE ORE IS ASSESSED	MEASURED	INDICATED	INFERRED
	THOUSANDS OF TONNES OF URANIUM		
Up to $100/kgU	29	117	149
$100 to $150/kgU	3	65	80
$150 to $300/kgU	17	40	94
SUB TOTALS	49	222	323
GRAND TOTAL	594 000 TONNES U		

WESTERN WORLD URANIUM PRODUCTION

OUTPUT IN 1990 IN TONNES U

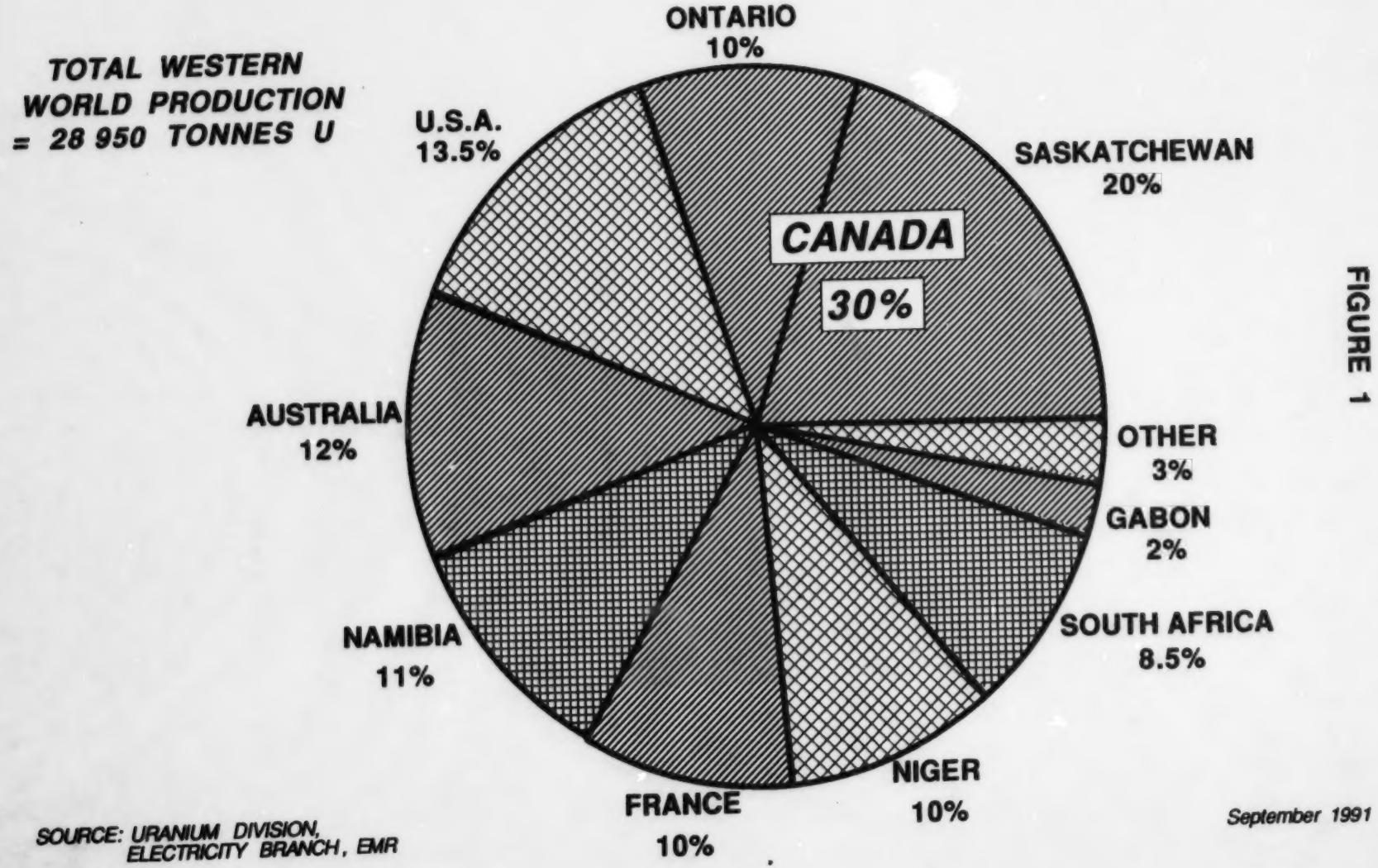

FIGURE 1

SOURCE: URANIUM DIVISION, ELECTRICITY BRANCH, EMR

September 1991

URANIUM DEPOSITS IN CANADA

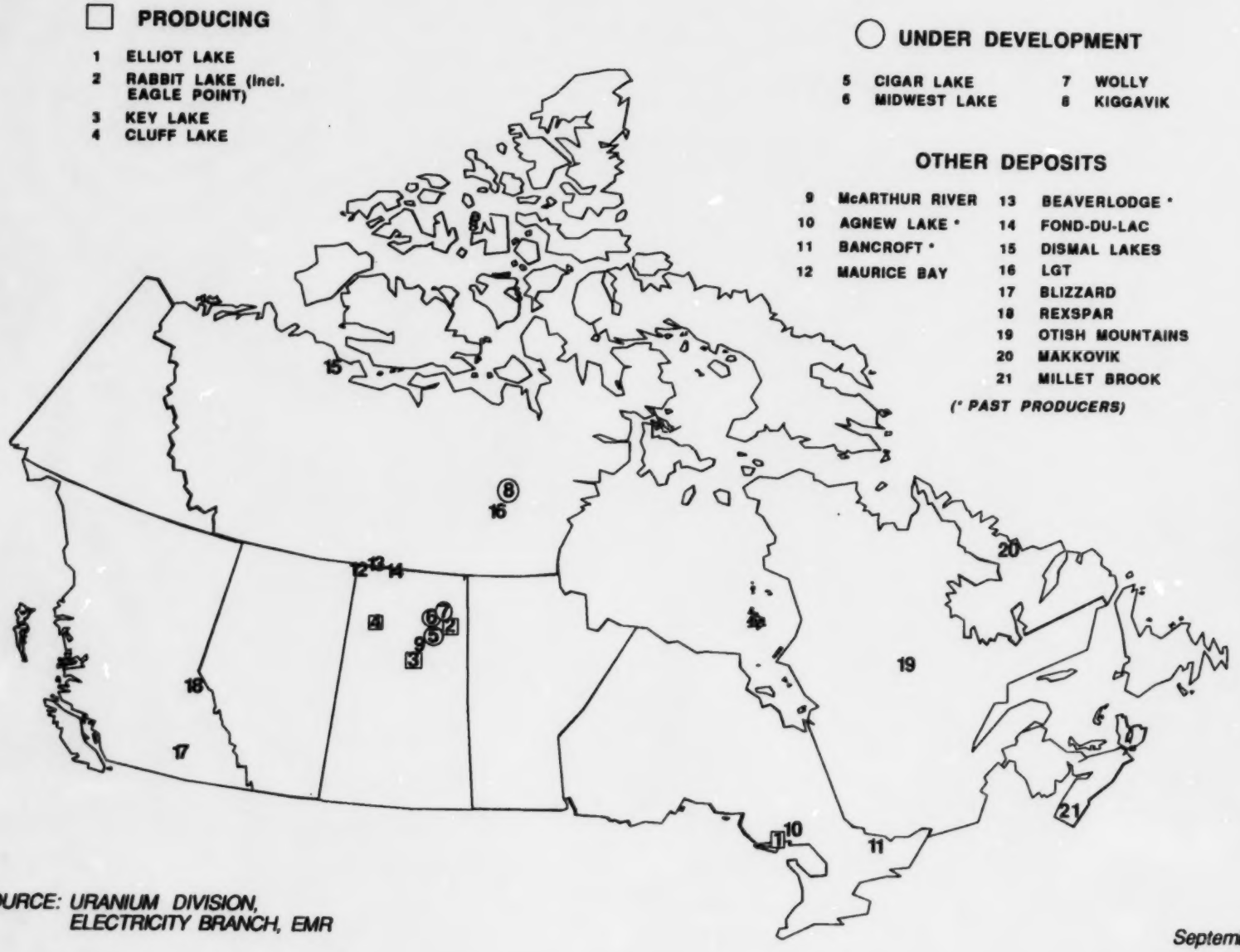

FIGURE 2

SOURCE: URANIUM DIVISION, ELECTRICITY BRANCH, EMR

September 1991

ELLIOT LAKE, ONTARIO, URANIUM PRODUCING DISTRICT

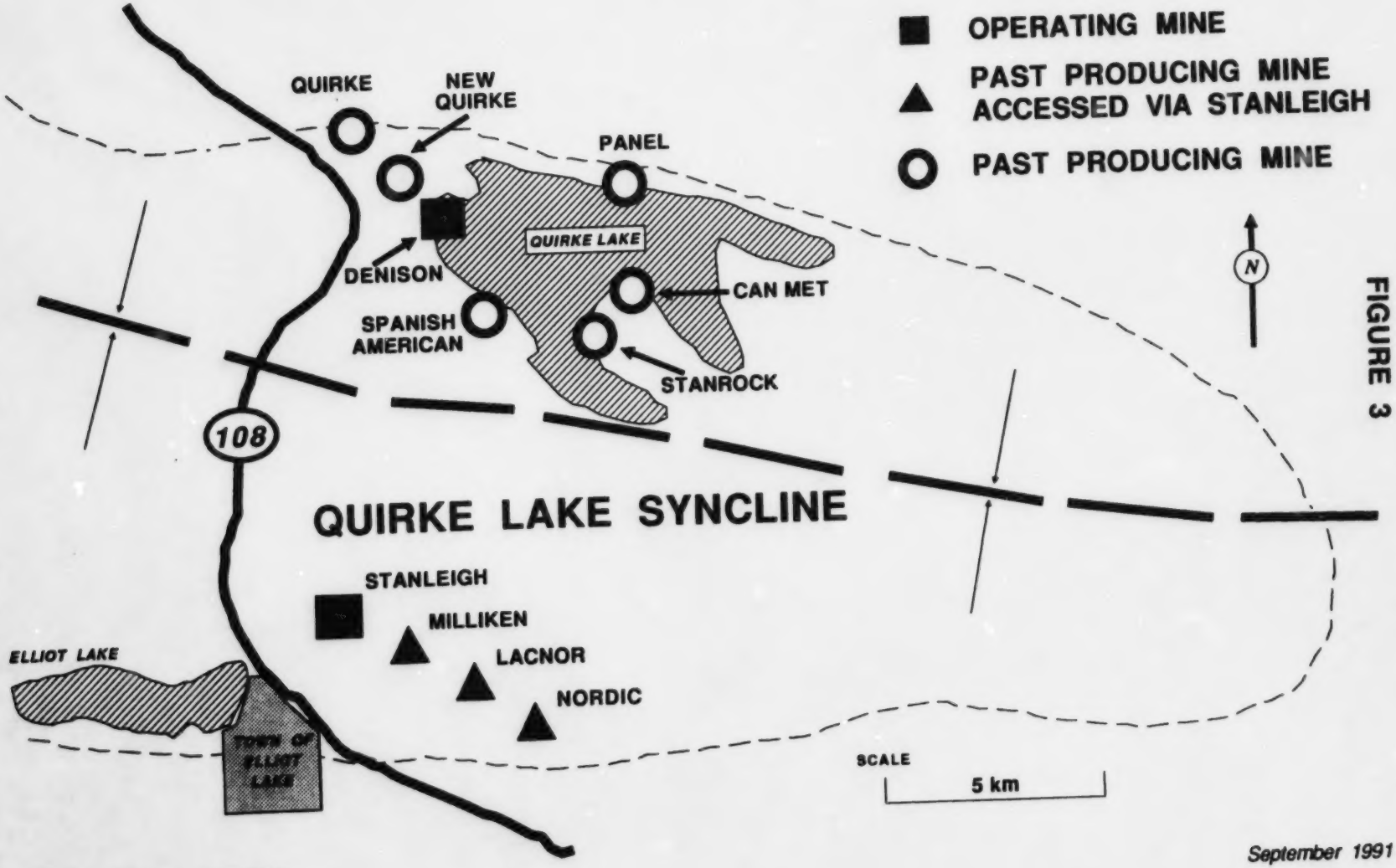

FIGURE 3

September 1991

SOURCE: *URANIUM DIVISION, ELECTRICITY BRANCH, EMR*

URANIUM DEPOSITS OF THE ATHABASCA BASIN, SASKATCHEWAN

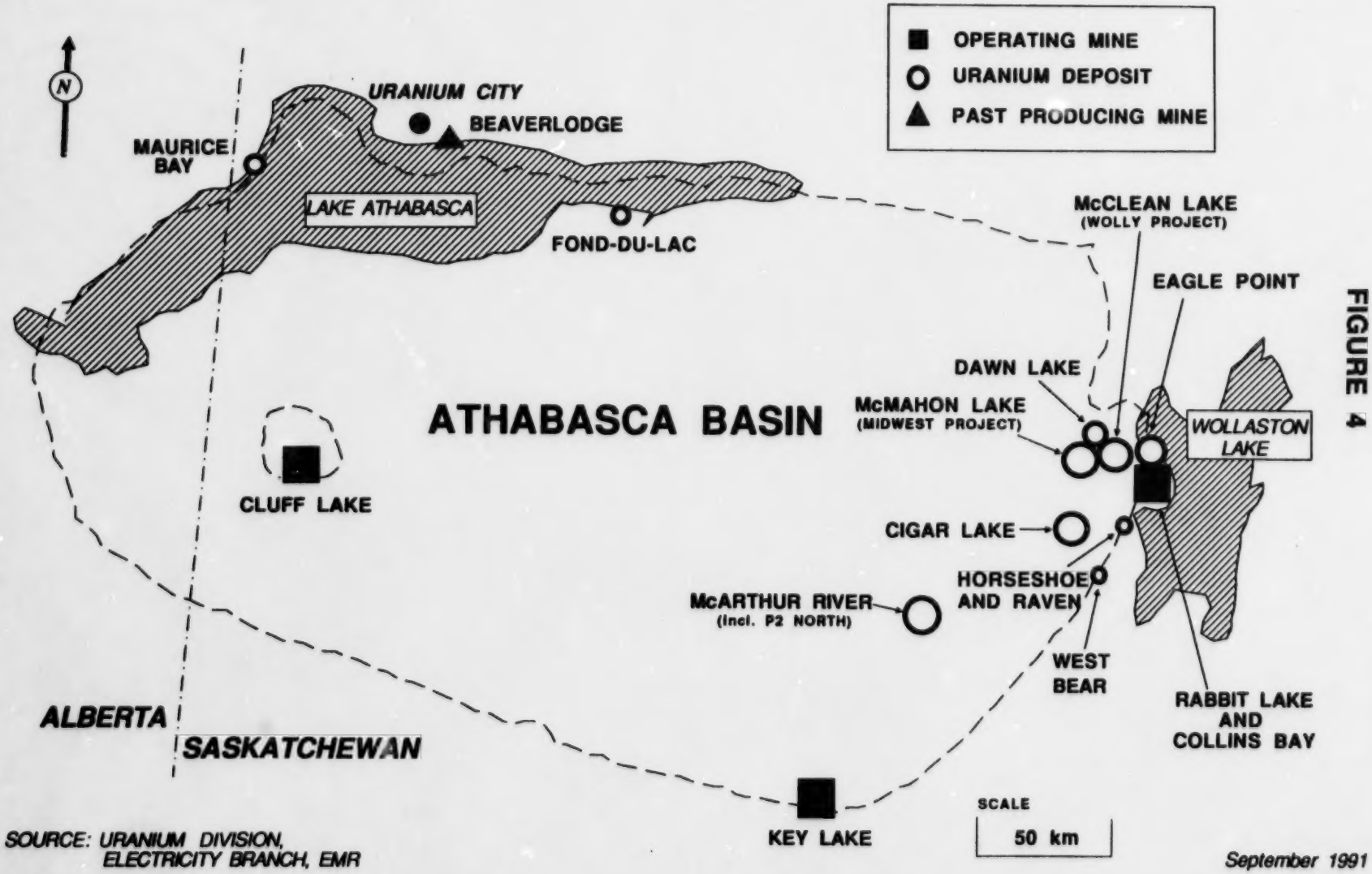

FIGURE 4

SOURCE: URANIUM DIVISION, ELECTRICITY BRANCH, EMR

September 1991

TREND IN URANIUM EXPLORATION EXPENDITURES IN CANADA

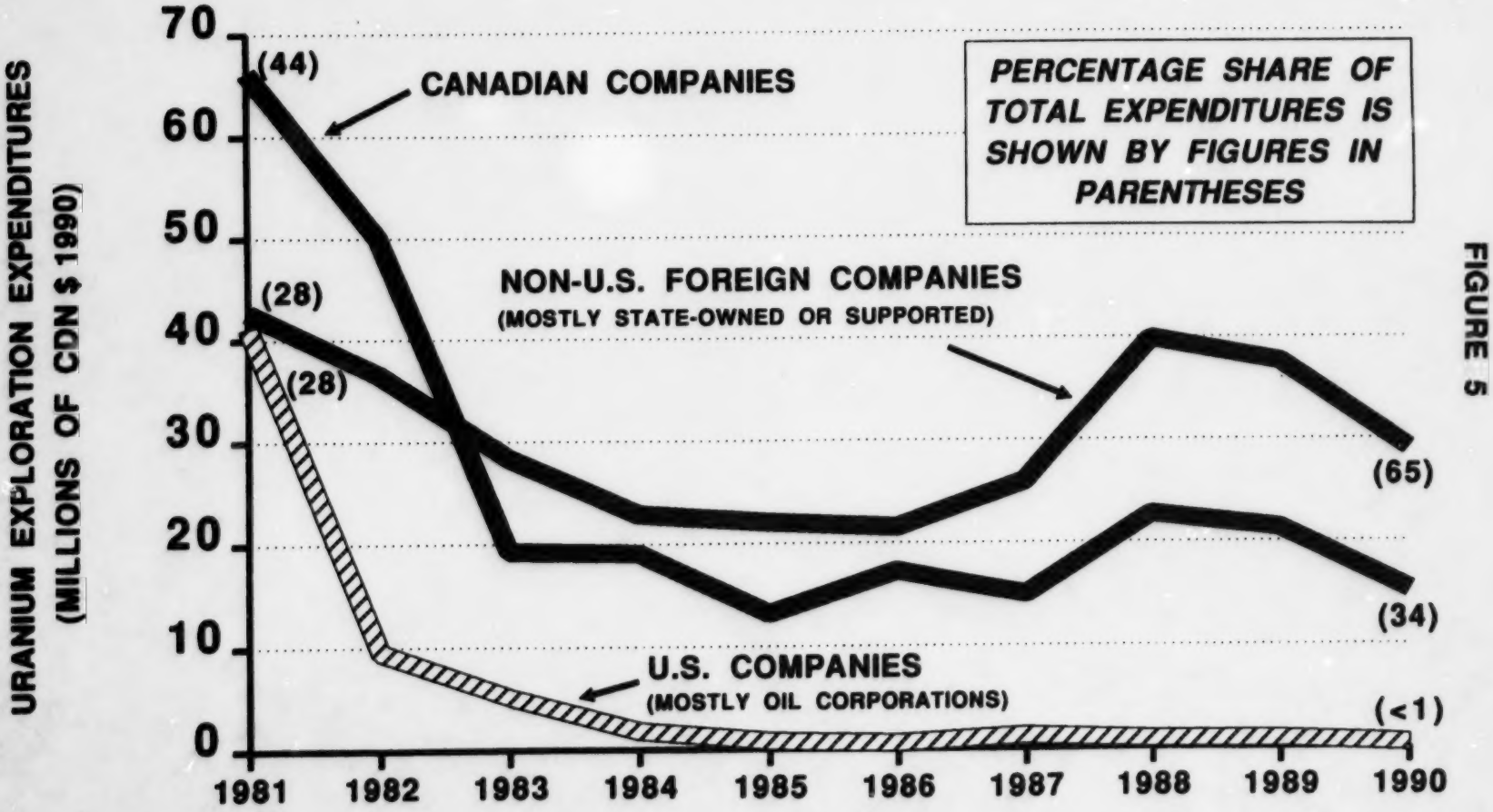

FIGURE 5

SOURCE: URANIUM DIVISION, ELECTRICITY BRANCH, EMR

September 1991

SHARE OF KNOWN URANIUM RESOURCES AT EXISTING PRODUCTION CENTRES

(TONNES OF URANIUM)

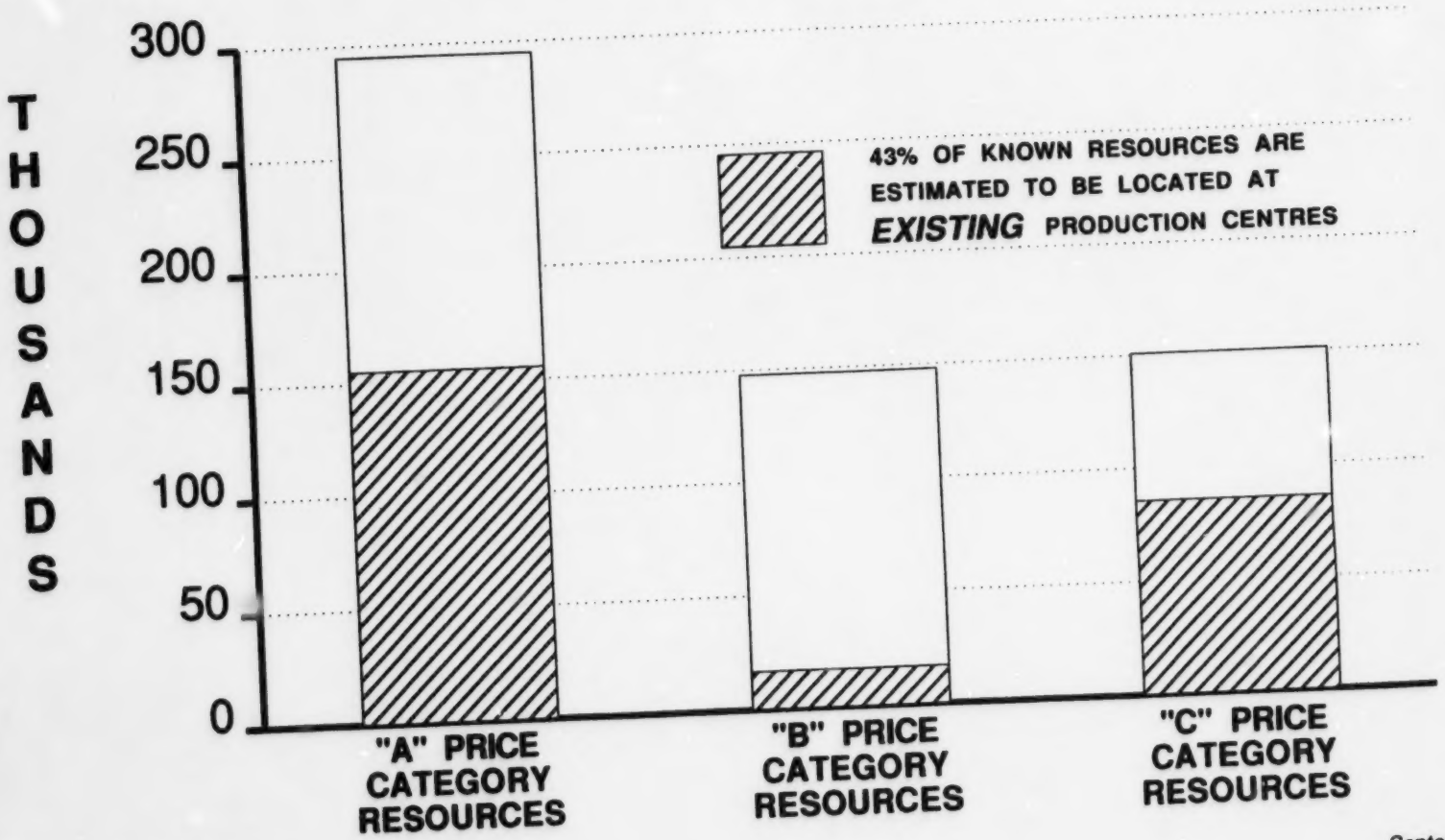

FIGURE 6

September 1991

SOURCE: URANIUM DIVISION, ELECTRICITY BRANCH, EMR

URANIUM PRODUCTION CAPABILITY COMPARED WITH REACTOR REQUIREMENTS

(TONNES U / YEAR)

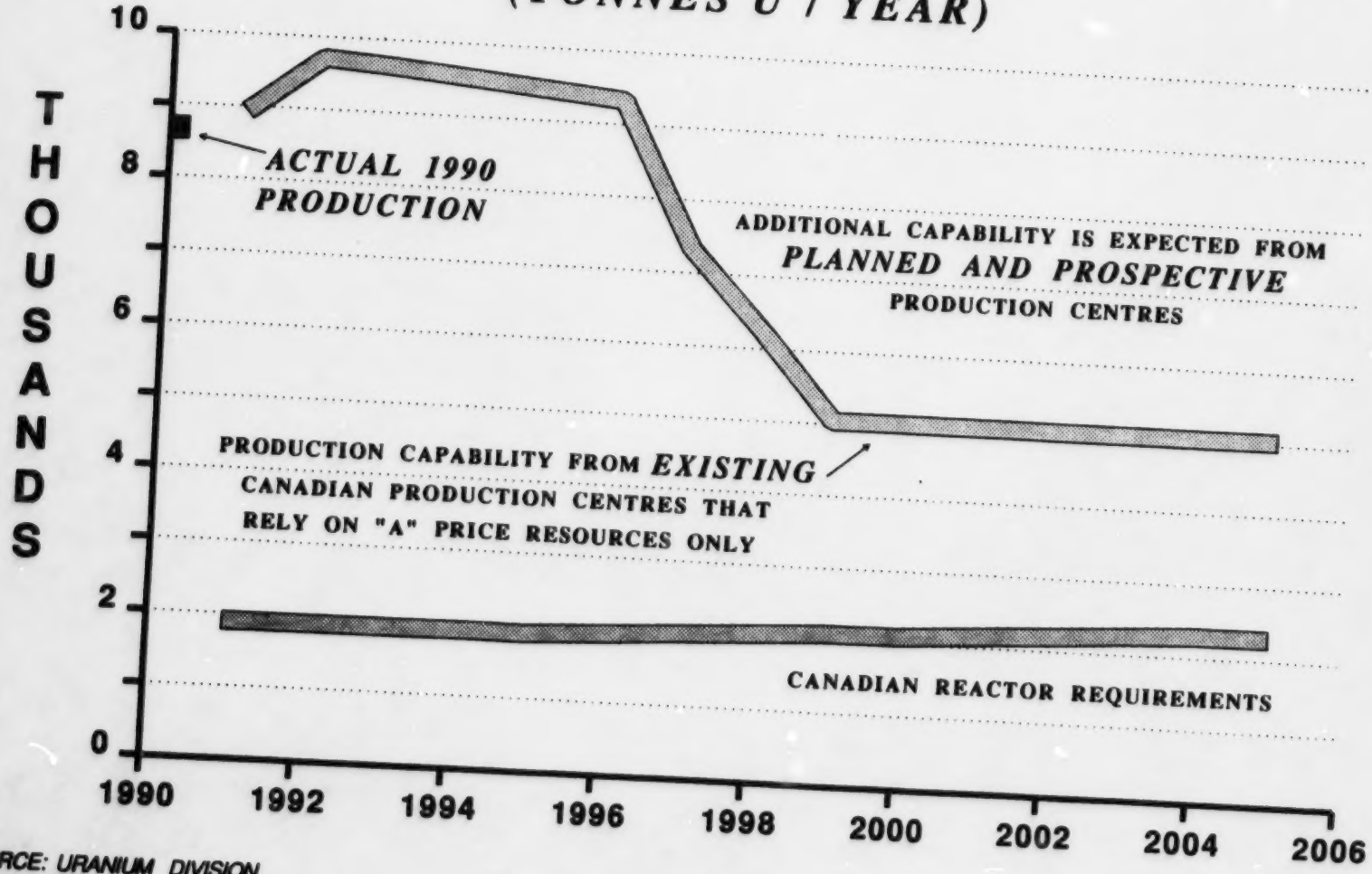

FIGURE 7

SOURCE: URANIUM DIVISION, ELECTRICITY BRANCH, EMR

September 1991

SCHEDULED DELIVERIES OF CANADIAN URANIUM FOR THE EXPORT MARKET

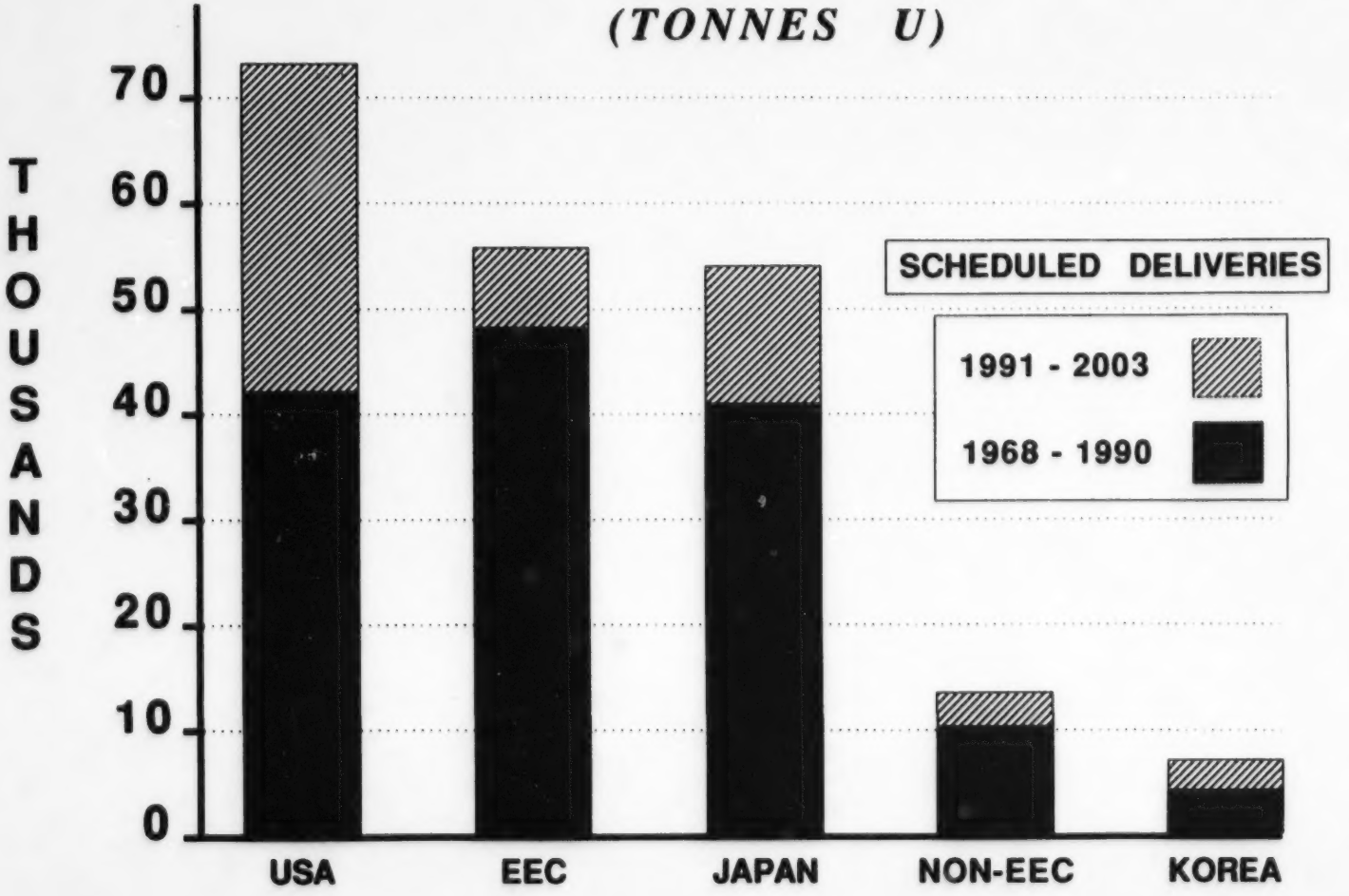

FIGURE 8

SOURCE: URANIUM DIVISION,
ELECTRICITY BRANCH, EMR

September 1991

CANADIAN URANIUM EXPORTS BY COUNTRY OF FINAL DESTINATION

1986 - 1990

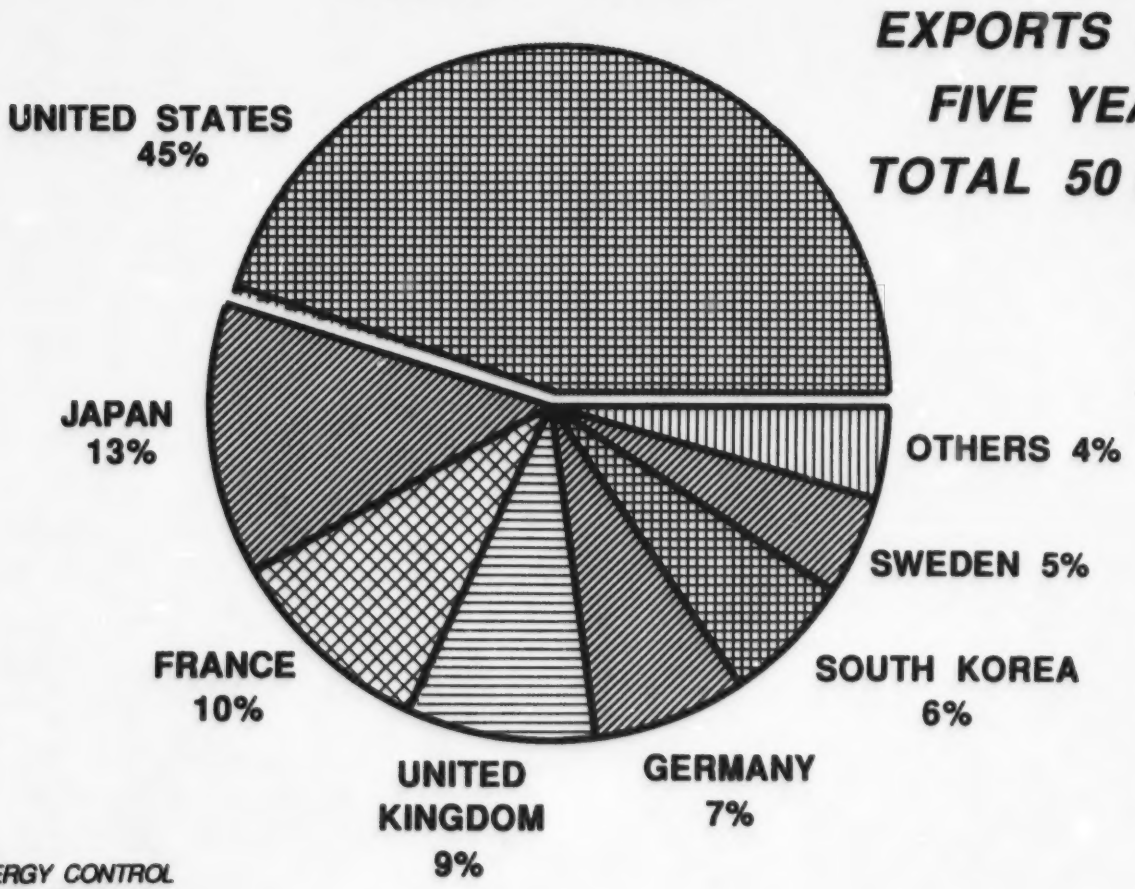

FIGURE 9

SOURCE: ATOMIC ENERGY CONTROL BOARD (AECB), CANADA

September 1991

DEVELOPMENT OF URANIUM PRICES FROM 1983 - 1990

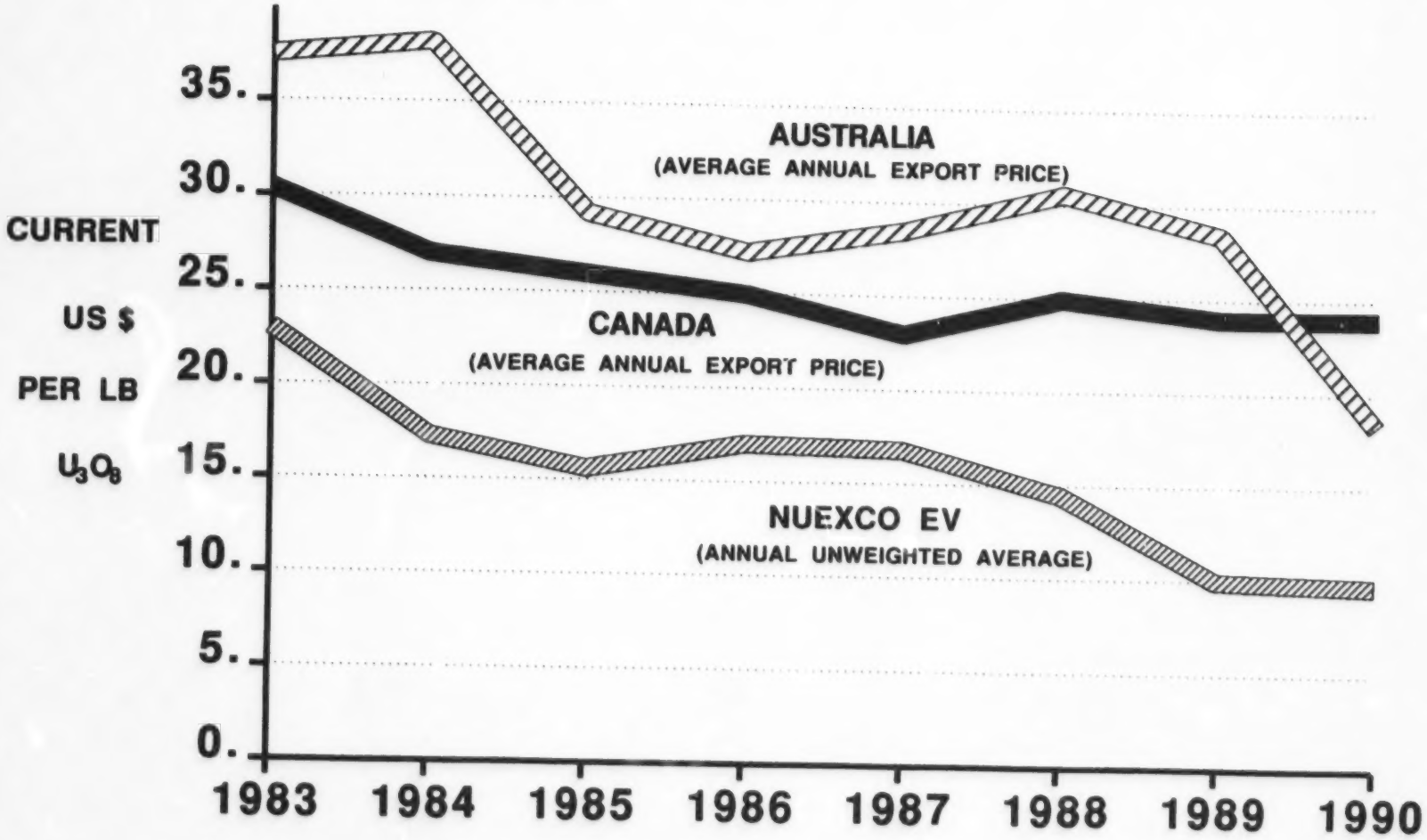

FIGURE 10

SOURCE: URANIUM DIVISION, ELECTRICITY BRANCH, EMR

September 1991

NUCLEAR SHARE OF ELECTRICITY GENERATED IN SELECTED COUNTRIES, 1990 AND 2005

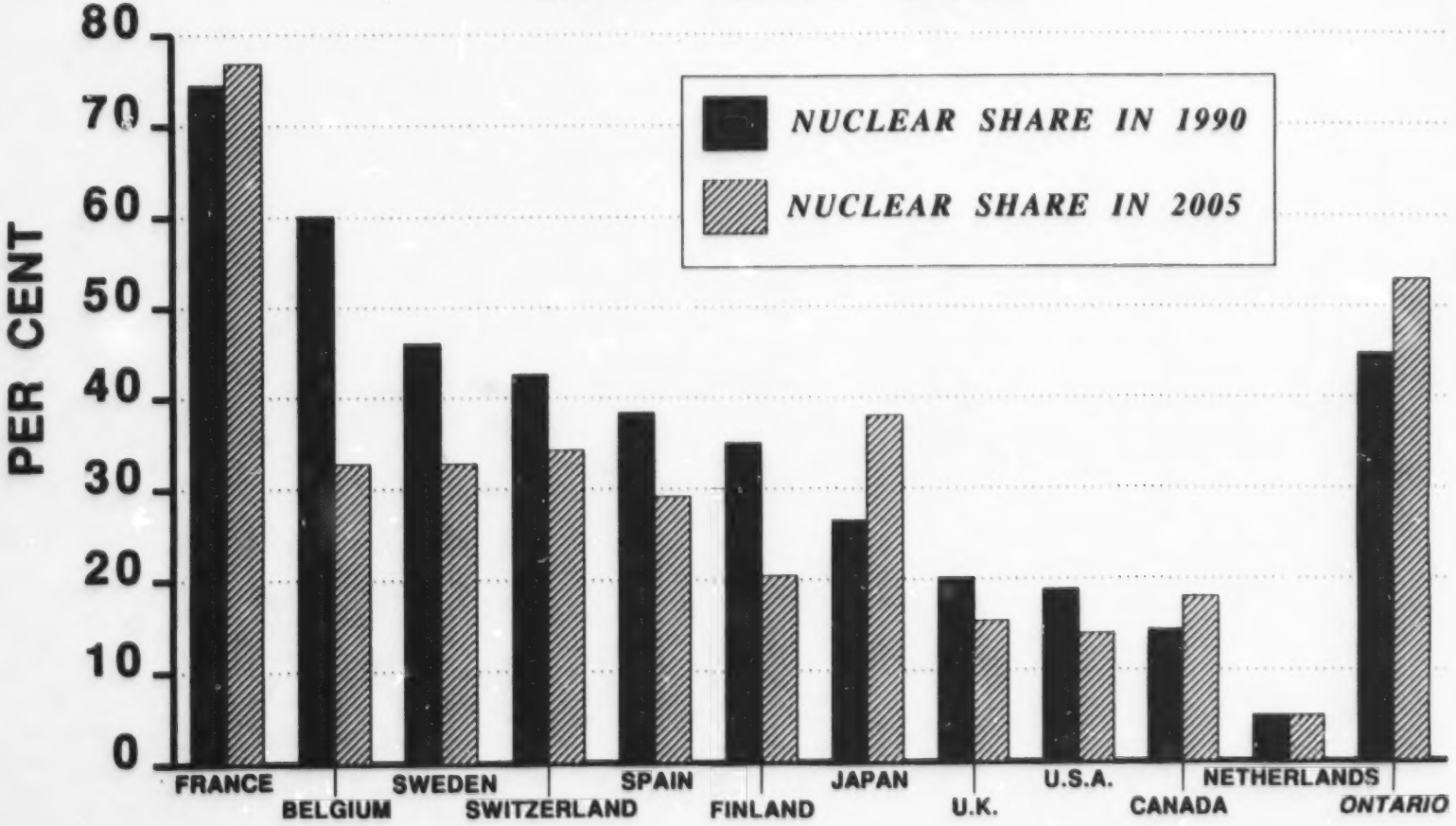

FIGURE 11

SOURCE: OECD/NEA AND ONTARIO HYDRO

September 1991